Devoted to
TEXTILE
CHEMISTRY
BLEACHING
DYEING
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FINISHING

JUNE 7, 1943
VOLUME 32, No. 12

AMERICAN DYESTUFF REPORTER

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OFFICIAL PUBLICATION
of the
PROCEEDINGS
AMERICAN ASSOCIATION
OF TEXTILE CHEMISTS
AND COLORISTS

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for quality and production!" has become the watchword of the American industries in the war effort.

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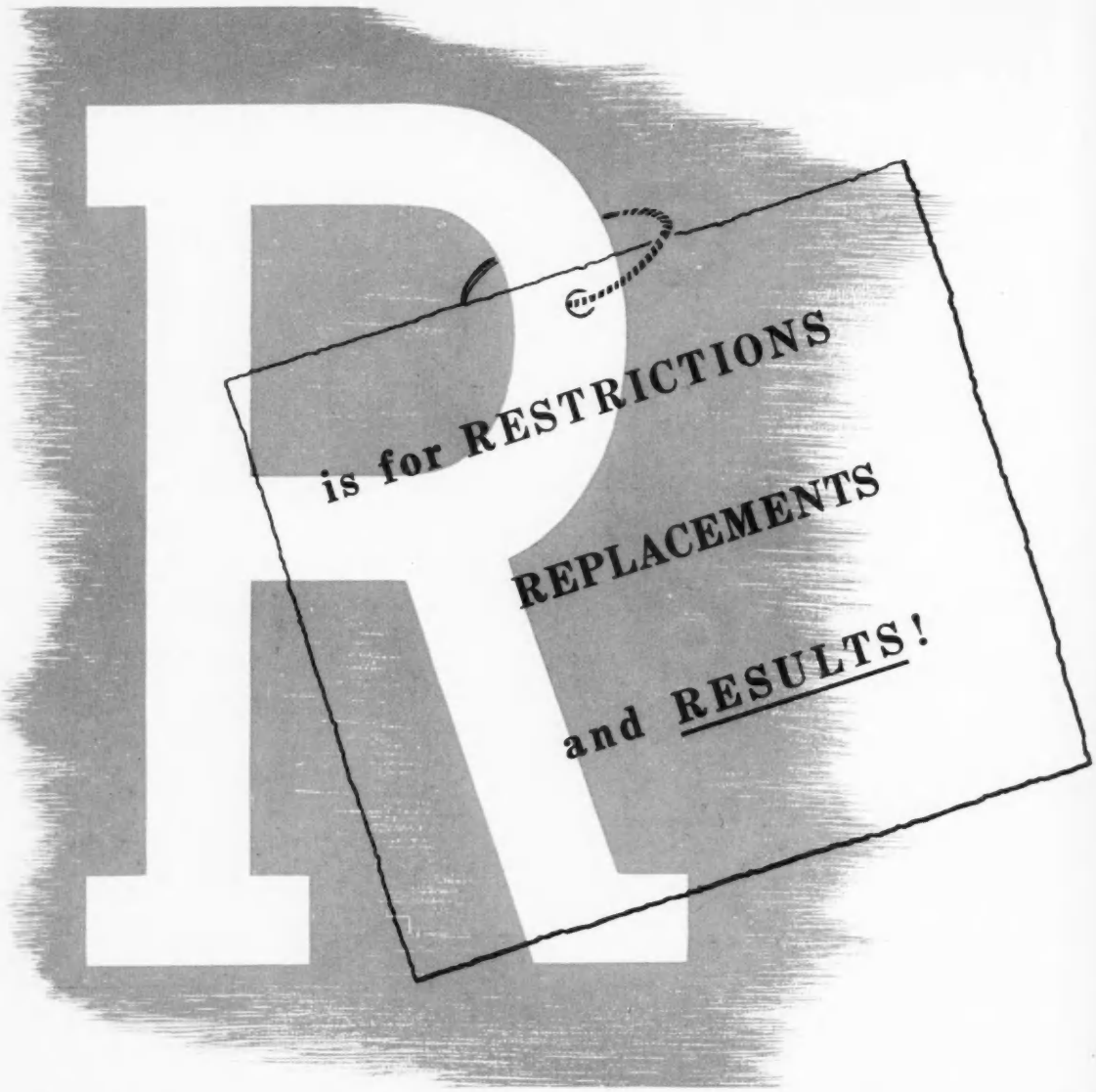

Getting results despite necessary restrictions of many chemicals to strictly high priority uses is of course a serious replacement problem for manufacturers of civilian goods.

The problem, an old one by now for many textile manufacturers and processors, is nevertheless rapidly being overcome by diligent efforts to relieve the situation. At Cyanamid, for example, new and larger capacities for production of essential chemicals are constantly going into action. At the same time, Cyanamid's intensified research is bringing about important developments in non-critical replacement materials. Thus relief may be said to be coming from two directions.

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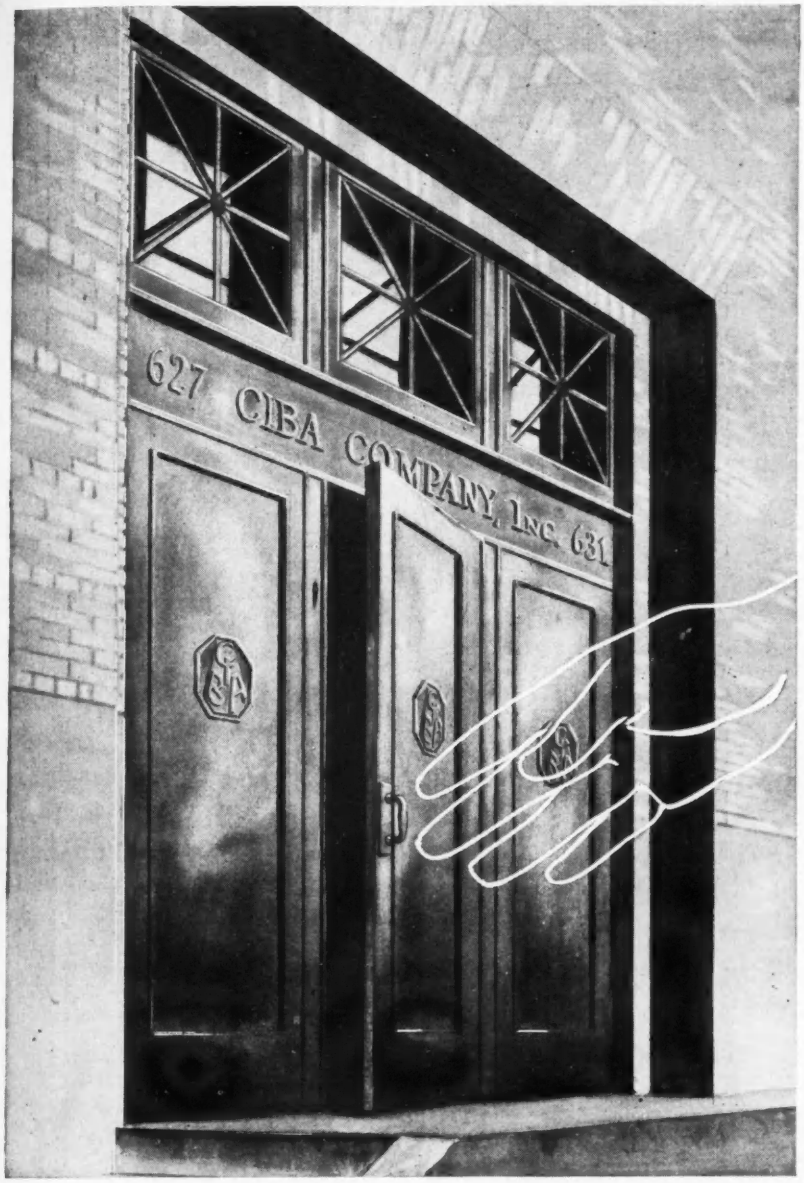

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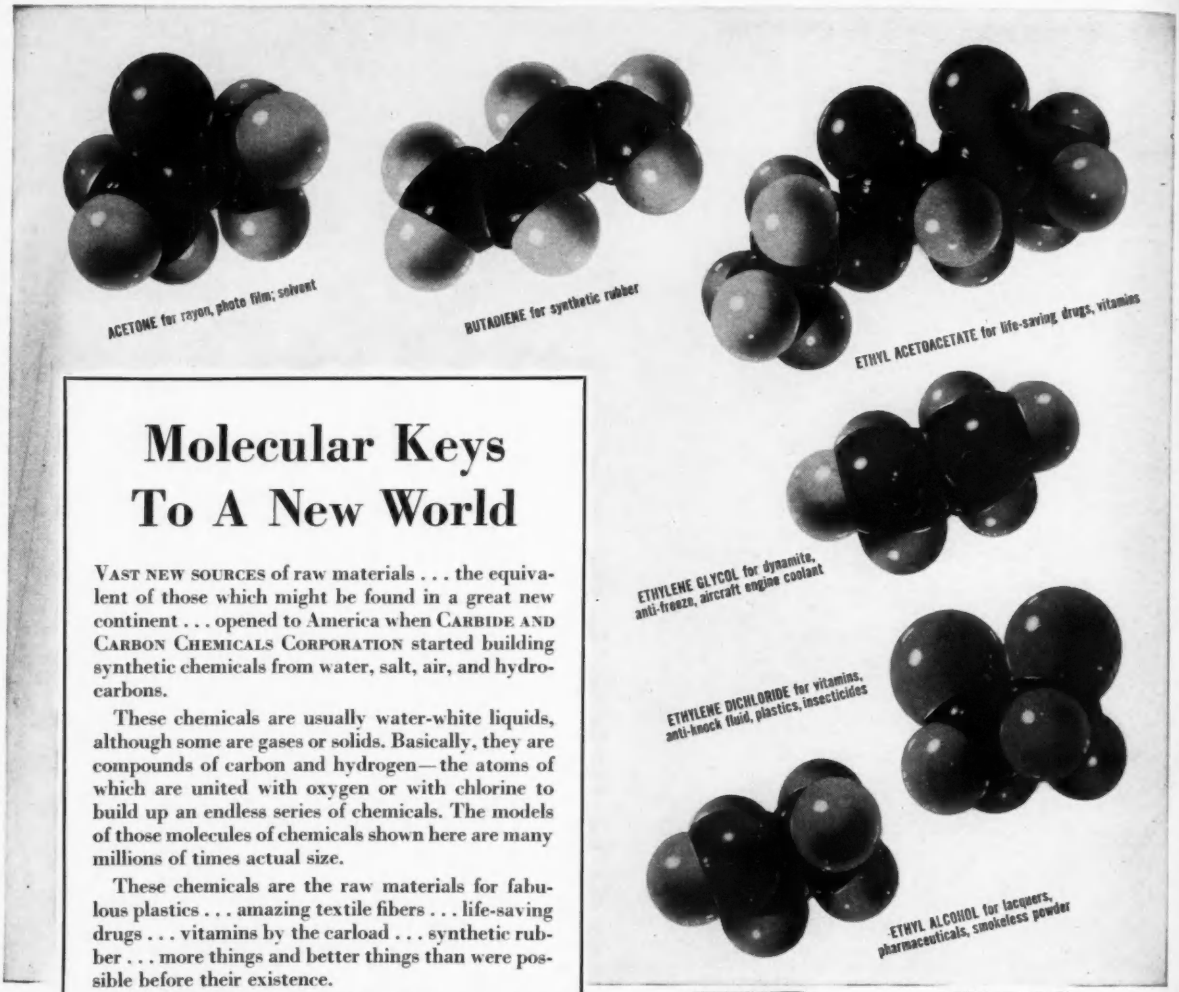
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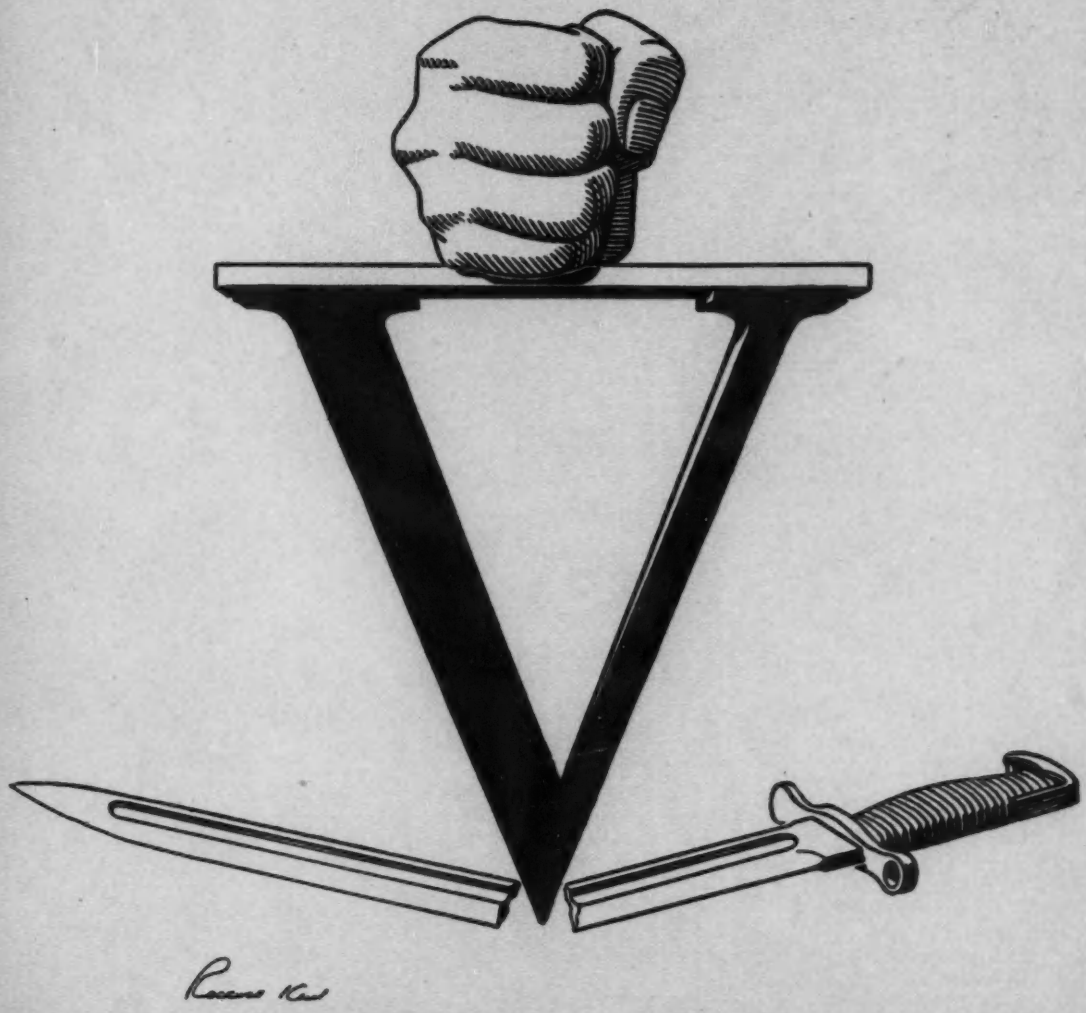

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KOPAN is available in several viscosities to provide a great variety of desired finishes with the required hand and appearance. Its low cost offers an attractive opportunity to forward-looking, progressive processors.

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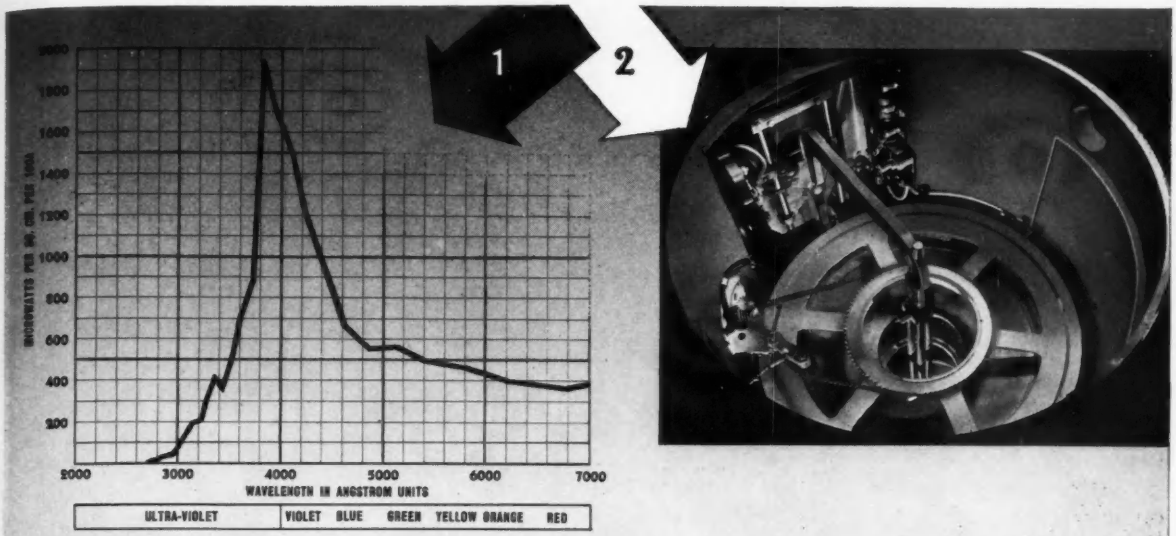

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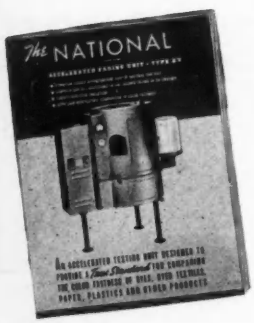

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JUNE 7, 1943

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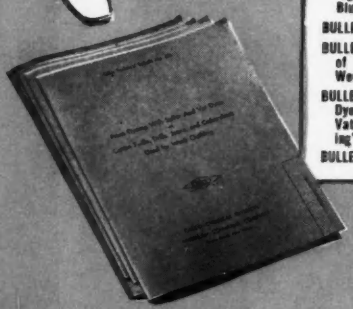

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JUNE 7, 1943

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Members should notify the **Secretary** immediately of all address changes.

MEMBERSHIP ON MAY 1, 1943

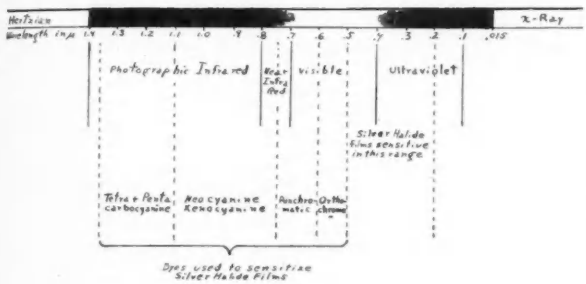
	Senior	*Junior*	*Associate*	*Student*	1943 *total*	1942 *total*	1941 *total*	1940 *total*	1939 *total*	1938 *total*	1937 *total*
Northern New England	315	43	49	..	407	398	391	349	327	311	303
Rhode Island	283	35	32	2	352	341	337	332	295	284	256
New York	568	56	82	1	707	651	606	538	483	451	409
Philadelphia	425	31	56	1	513	517	475	447	381	369	326
Piedmont	248	14	24	..	286	309	297	293	277	247	238
South Central	67	2	3	..	72	80	71	61	63	56	41
Southeastern	102	8	21	15	146	175	142	137	133	109	55
Midwest	165	9	24	..	198	194	193	180	157	158	147
Lowell Textile Institute	..	..	..	25	25	49	43	31	25	19	11
North Carolina State College	..	..	..	12	12	19	17	15	8	10	5
Philadelphia Textile Institute	..	..	..	7	7	20	20	13	18	28	25
New Bedford Textile School	..	..	..	12	12	29	..	..	..	..	..
No Section	81	32	9	—	122	82	87	80	71	65	55
	2254	230	300	75	2859	2864	2679	2476	2238	2107	1871
Corporate Members	..	..	..	..	82	77	33	33	32	30	30
					2941	2941	2712	2509	2270	2137	1901

In addition to the above are the members in the Armed Services who are not subscribers to Reporter and Year Book.

Infrared Reflecting and Fluorescent PIGMENTS ON TEXTILES for the Armed Forces*

R. KENNETH JACKSON
Wesco Waterpaints, Inc.

THE armed forces are becoming increasingly interested in the controlled reflection of energy wavelengths beyond both ends of the visible spectrum. Examination of the spectrum from the shortest wavelength



ultraviolet, in the neighborhood of .10 micron, up through the visible spectrum to the longest wavelength in photographic infrared, approximately 1.4 microns, shows that the sensitivity range of the silver halides used in photographic plates is narrow; and that even including modern films sensitized with panchromatic dyes, the range is still quite narrow, extending only half way into the near infrared. Later developments, however, such as special infrared sensitized photographic plates employing the tetra and penta carbo-cyanine dyes show an effective range up to almost 1.4 microns wavelength. In this range, from .8 to 1.4, very interesting results can be obtained photographically by masking out the visible spectrum with filters which will pass only wavelengths above .7 micron.

It is also possible to take very clear pictures through haze and light fog in this longer wavelength band, as light scattering is an effect caused by the relationship between wavelength and particle size of fog or smoke. A good example of this is the effect of tobacco smoke appearing blue in the air when the condensed smoke is actually brown in color, the reason for this being that the smoke particles average approximately .60 micron in size and fall in the blue part of the visible spectrum, therefore scattering the light of that wavelength and giving the appearance of blue smoke. The longer wavelengths of infrared are not affected by particles of this size, so are not defracted but continue on a straight course. This means that pictures taken on a hazy day, with a film sensitive to these long wavelength bands will show up details which could not be discerned by the human eye in the visible spectrum. These films are so sensitive that one can take pictures in a totally dark room, using an infrared source which gives no visible light, such as an electric flatiron. This is called "black body radiation."

For army applications the interest is centered in the reflection and absorption powers of specific surfaces for this invisible light. A good example of this application would be a gun emplacement in the field which has been covered with camouflage network colored to match the surrounding foliage. From an airplane this gun may be so well camouflaged as not to be apparent to the eye. Foliage, however, is highly infrared reflecting, and will appear white on an infrared film; but if the pigments used in the camouflage were not highly infrared reflecting, the gun emplacement would stand out in the picture as a black spot. The textiles commonly used for camouflage of this type are Osnaburg cloth, Johnson & Johnson batting, burlap, etc. In some cases tent cloth, so treated, may be desirable.

In comparing the relative reflecting properties of pigments and dyes it is found that some dyes are infrared reflecting in the longer wavelengths, while they are totally nonreflecting in the shorter wavelengths, of the infrared. Moreover, a dye's reflection will change according to the mordanting treatment and the particular type of textile to which it is applied. Pigments, on the other hand, can be classified definitely as being either nonreflecting, partially reflecting or totally reflecting. There is also the fact, which cannot be escaped, that dyes fading in the visible spectrum will also fade in the infrared; whereas the earth pigments, such as chrome oxide green, have much greater permanence. In addition are the questions of comparative sheen and opacity; as dyeing constitutes an internal change in the fiber, whereas the pigment treatment changes the *surface* of the fiber.

One point of interest in making infrared reflecting colors with pigment is the remarkable inhibitive powers of very small percentages of black. A very high infrared reflectance can be destroyed almost completely by as little as 1 per cent addition of a black pigment.

*Presented at meeting, Northern New England Section, March 12, 1943.

Aside from the army's interest in this reflection phenomenon, there are certain possible future uses in civilian life. Due to the fact that infrared rays bring about thermal activity in surfaces which do not reflect them, there is a definite rise in the temperature of the surface. An interesting example of this is the instance of black-out paints on glass. When these paints are highly infrared absorbent, strong sunlight will sometimes cause the glass to shatter, due to the heat build-up on one surface, which causes stresses in the structure of the glass. In pigment dyeing, this thermal control might be utilized in seasonal fabrics. The methods and means for determining infrared reflection are fairly simple. The apparatus necessary is an ordinary small camera, but with a metallic shutter, as hard rubber sometimes allows leakage of infrared and consequent fogging of the film. Infrared sensitive films or plates can be obtained easily. A filter should be used, to permit the passage of only infrared wavelengths, one of the best for this purpose being the Wratten No. 87. For an infrared source ordinary mazda bulbs can be employed, in a doughnut shaped reflector with seven or eight bulbs placed in a circle. For more complete information on making these tests a very good reference is "Photography by Infrared," by Walter Clark of the Kodak Research Laboratories, second edition, 1941.

Traveling from photographic infrared down through the visible spectrum to the shorter wavelengths, we come to the ultraviolet spectrum, sometimes referred to as "black light." The reflectance of this also is of interest to the armed forces, but in a slightly different application.

The shortest wavelengths of ultraviolet reaching the earth from the sun are approximately .29 microns, but by artificial means such as a mercury arc we can generate slightly shorter wavelengths, approximately .25 microns, which exhibit strange and useful properties. These rays are very useful in sterilization and deodorizing, because of their ability to generate ozone which in turn yields nascent oxygen. But, the wavelength in which we are interested optically lies just below the visible spectrum, approximately .36 microns. When directed at certain sulfides or dyes this is reflected, but not in its original form. According to the specific material, the ultraviolet is actually changed to some wavelength in the visible spectrum. By zinc sulfide it is reflected mostly in the green and yellows by cadmium sulfide in the yellow, and by strontium sulfide in the blue.

The air corps is more than mildly interested in this property, called fluorescence, and interesting as this topic may be, little more can be said to the general public concerning it until after the war. For companies doing war work, specifications can be obtained from the air corps covering fluorescent fabrics treated with dyes or pigments. Present civilian use for this material is confined mainly to theatrical properties such as bunting, costumes, and special lighting effects. Fluorescent tubes, which are growing in popularity, utilize this pigment fluorescence to produce various colored lights. A possible future use might be in highway markers or signs enabling cars to see their way clearly without the use of strong, blinding headlights on open country roads. Each car would possess a black spotlight as its own source of ultraviolet, for activating road markers into fluorescence.

In this paper, we have discussed two of the many types of pigments. For application to textiles there are two very different processes; first, the oil phase system, in which pigments, dispersed in a vehicle of drying oils, resins or thermo-plastic resins, are padded on to the surface of fabrics in manner comparable to lithographing; and second, the water phase system, in which pigments in a suitable water dispersable binder are deposited on the fibers by electro-kinetic attraction, and fixed there, permanently. In the latter, not only is the surface colored, but the fabric is thoroughly impregnated, making it appear, even on fairly close examination, almost the same as if dyed.

It is my opinion that both methods will gain in popularity in a widening field both during and after the war. In many instances pigments will do the job better than the best organic dyes. This applies to high quality merchandise as well as the jobs in which we are less particular.

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• CALENDAR •
OF COMING EVENTS

Council and Research Committee Meetings, June 19. Providence Engineering Society Bldg., 195 Angell St. Providence, R. I.

NOTE: The outing of the Rhode Island Section, originally scheduled for June, will not be held.

Annual Meeting and Dinner, Philadelphia Section, Cedarbrook Country Club, Limekiln Pike above City Line, Mt. Airy, Philadelphia, Pa., July 9, 1943

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The Application of WATER DISPERSED PIGMENT COLORS to Textiles*

FRED G. LA PIANA
Stein, Hall & Co., Inc.

THE art of decorating textiles with pigments is not altogether new. Under the name "pigments" we mean finely comminuted coloring matter, organic or mineral, either occurring in nature or synthetic, which is insoluble and chemically inactive in the medium before, during and after the process of application to the surface of the cloth.

In terms of chemical and physical results, decorating textiles with this type of coloring matter, properly speaking, has no relation with the art of dyeing, but it is more closely allied to the art of painting. It is usually described under the terms of dyeing and printing for the simple reason that the methods employed and the visual results are the same as those of orthodox dyeing and printing, in which a physico-chemical reaction takes place between the coloring matter and the fiber. No such reaction takes place when pigments as such are applied. The pigment is simply glued to the surface of the fiber through the medium of a binding and film forming substance.

As in all paints intended for other purposes, in pigment compositions intended for dyeing and printing cloth four properties are of paramount importance—

1. The nature and constitution of the coloring matter and its inactivity and resistance to changes under varying light and atmospheric conditions.
2. The state of dispersion of the pigment. This includes the size of the particles to which the coloring matter has been comminuted, the hiding power, the tendency of forming agglomerates and of settling.
3. The binder of film forming substance which is intended to bind the coloring matter to the fiber, and the plasticizing agents that may be necessary to render the film flexible and soft.
4. The vehicle which is intended to dissolve or colloidally disperse the film forming substance and to extend it to the viscosity and dilution required for proper application.

We shall limit our discussion tonight to the third and fourth items: to the binder or film forming substance, and to the vehicle. These two ingredients, as you well understand, are strictly correlated one to the other and in a discussion of this kind they can hardly be separated and should be considered together.

The film forming substance can be of two kinds:

Hydrophobic—insoluble in water but soluble or colloidally dispersible in a hydrophobic organic solvent.

Water Soluble—or colloidally dispersible in water. With this of course the only solvent or vehicle needed is water.

The other type, the soluble or colloidally dispersible in a hydrophobic organic solvent, can be compounded in two different forms: either with a straight organic solvent as a vehicle, or in emulsion containing both water and solvent as a vehicle.

Conceding that other necessary qualities can be imparted to it such as plasticity, flow and body, theoretically the less water soluble and more hydrophobic is the film forming substance employed the better will be the results for fastness to changing atmospheric conditions, to washing and what is usually designated as wet crocking. The fastness to dry cleaning may be expected to be nil, fair or good according to the solubility of the binder in the organic solvent used in dry cleaning. The best vehicles for this type of binder are straight hydrophobic organic solvents of low cost and high flash point. The dry pigment can be ground directly in a concentrated solution of the binder in a roller or ball mill and subsequently extended to the proper concentration and viscosity. This method of application is recommended especially when, besides coloring the cloth, a high concentration of solids and pigments is required to impart to it other qualities such as flame resistance, mildewproofness and water proofness. Millions and millions of yards of canvas, tarpaulin and tent material are being treated with this method for the Army. The advantages are superior resistance to weather changes and to water and superior penetration. For ordinary civilian uses the disadvantages and drawbacks of this method would be many. First, there is a continuous and serious fire danger; secondly, unless a solvent recovery system is installed, which in itself would be costly to install and operate, this method is very costly as compared with the water soluble binder or emulsion methods. As now operated practically all dyeing and printing plants in this country are equipped to wet process goods with water as vehicle, and if the solvent method is to become of

*Presented at meeting, Rhode Island Section, April 30, 1943.

general use, new equipment and separate buildings properly ventilated would be required.

Another drawback is the uncertainty of the binder resistance to the various dry cleaning and spotting fluids. While this phase of the problem could be easily controlled as far as the commercial dry cleaner is concerned by properly labeling the goods, you never can tell what an ordinary consumer or housewife is going to use to rub off a grease spot or a stain. If he or she happened to choose or have on hand a fluid in which the binder were soluble, the results surely would not be pleasing and a complaint would follow.

The next method to be considered is that of the emulsions. These consist of an insoluble color pigment dispersed in an emulsion of a hydrophobic, organic solvent solution of a water insoluble binder or film forming substance properly plasticized as required. There are two types of these emulsions. One, the so called oil in water emulsion in which the film forming substance and its solvent are the internal non-continuous phase, and the water is the external continuous phase—and the other the so called water in oil emulsion in which the water is the internal non-continuous phase, and the film forming substance and its solvent the external continuous phase.

Whatever type of emulsion is used, it is important that the pigment be thoroughly dispersed in the phase in which the film forming substance exists. By the expression of "thoroughly dispersed" I am referring not so much to the size of the pigment particles, which of course is very important for other reasons and is not under discussion tonight, but I refer to the importance that each particle of pigment be thoroughly coated by a film of binder solution not only to insure isolation of each particle from the others and eliminate agglomeration, but mainly to prevent the water phase from wetting the surfaces of the particles. Since the water phase and the oil phase are mutually repellent, if a film of water is formed around the particles of pigment it will preclude intimate contact with the binder, and on evaporation of the moisture, the pigment will be loosely embedded in the binder film and the fastness to washing and crocking will be proportionately and greatly reduced.

Of these two types of emulsion, no doubt the water in oil emulsion is generally to be preferred, although it has some distinct drawbacks. In a water in oil emulsion the viscosity of the composition may be varied as desired by varying the relative proportion of the two phases. Addition of water to the internal non-continuous phase will raise the viscosity and increase the thickness of the emulsion. Addition of solvent to the external continuous phase will have the reverse effect. By proper adjustment of these two elements, which on drying are both eliminated, any viscosity most suitable for the work on hand may be obtained, independently of the solid content of the emulsion. This is quite an advantage especially in printing. It permits very low concentration of film forming substance, low cost and very soft prints. With oil in water emulsions this relation between viscosity and relative proportion between the continuous and non-continuous phase does not operate as well. The viscosity of the emulsion is mostly dependent on the concentration and viscosity of the film forming substance solution, and to eliminate the necessity of using a high concentration of this material with consequent stiff prints and high costs, it is often necessary to add to the external phase (that of water) a supplementary hydrophylic thickening agent, which may be washed out after.

Another advantage of the water in oil emulsion is that due to the low concentration of binder and mutual repellency of the two phases excellent prints can be made from photogravure and other shallow engravings with retention of complete details and the use of a minimum of coloring matter.

A serious disadvantage of this type of emulsion is the relatively large amount of organic solvent employed. It is necessary to use not only what is strictly needed to dissolve the film forming substance, but much more to properly balance the emulsion and obtain the needed body and thickness. On the other side with an oil in water emulsion a very limited amount of organic solvent is needed, just enough to put the film forming substance in solution. In consequence this type of emulsion has no objectionable features of fire danger, and offensive vapors and fumes, which are distinctly present in the other type of emulsion.

And now we come to what I believe to be the oldest and at the same time the newest method of applying pigment to cloth. This includes the use of water soluble or colloidally water dispersible film forming substances using only water as the solvent and dispersing fluid.

It is evident and plain that if the results obtainable by the application of this method compare in the majority of cases favorably with the results obtainable by the use of organic solvents and solvent emulsions, this method would be far more economical, far more acceptable, and far more adaptable to present equipment. A great deal of work has been done and is being done now to improve this method and we hope in the near future that the above statement will be realized in its fullness. In the meanwhile thousands and thousands of yards of cloth are being daily processed with this method with satisfactory results.

The use of albumen to fix white pigments in discharge patterns is probably the oldest large scale application of this method. You are all familiar with it. Latex, which is a natural dispersion of rubber in water, has been used extensively for fixing pigments on coated fabrics. The use of milk and casein as binder for decorative purposes was known to the ancients.

More recently a new class of materials has been developed: the water soluble and water dispersible synthetic resins, which are applied as such to the cloth and subsequently made water insoluble by heat curing. These include the water soluble polymers of urea formaldehyde, vinyl and acrylic resins. These all are excellent binding agents for pigments and can be properly and easily plasticized. Especially important in this class are the protein-urea-formaldehyde complexes which can be rendered water insoluble not only by heat curing but also by precipitation with acid.

Other important members of this class of binders are the alkali soluble hydroxy ethyl celluloses, which also are rendered insoluble in consequent acid treatment.

The latest discovery in this field which promises to outclass all others as to facility of preparation, application, control and cost is the discovery that some complex organic compounds of very high molecular construction, which, strictly speaking, are not soluble in water, cold or hot, but by their nature are capable of absorbing a huge amount of water to yield viscous jellies and colloidal dispersions, can be made hydrophobic and water resistant by chemically blocking the OH or hydroxyl groups through which they absorb the water. To what degree this blocking can be accomplished depends not only on the activity of the blocking agent but also on the position of the hydroxyl groups. Some of these groups are in the periphery of the molecule and can be easily reached, some are internal and more difficult to approach without somewhat breaking down the molecule and altering some of the properties of the dispersion. As the water molecules bound to the OH groups must be all out before the blocking agent can take their place, this explains the fact that with this class of binders thorough drying is essential to obtain the necessary fastness to washing, although the degree of temperature to which the cloth is heated is not critical and heat curing, as the term is understood when applied to synthetic resin polymers, is not needed or desirable. It is natural that the OH groups lying in the periphery of the molecule are more easily dehydrated, and it is natural that the internal groups hold the water more strongly and is almost impossible to wholly dehydrate them without altering the internal structure of the molecule. This explains the fact that on long immersion some water finally seeps through to the unblocked internal hydroxyl groups with consequent partial softening of the film and liability to wet crocking. This phase of the problem is now under close investigation and there is evidence that a satisfactory solution will be forthcoming soon.

I have here a set of cards representing laboratory strike-offs of typical water dispersed pigment pulps of various inorganic and organic pigments which are at present finding use in the textile trade in conjunction with binders and film forming substances of the last named class. At the right of each card you will find for each pigment fastness ratings to light test, to wash test, to sublimation test and dry cleaning test. Crock fastness evaluations are not given in as much as all pigment prints, regardless of the binder, vehicle or printing method used, show noticeable crocking both wet and dry. And here, we have arrived at the one and real weakness and deficiency and objection to this method of decorating and coloring textiles. You will notice that while the fastness to light, to washing, to sublimation and dry cleaning is equal and in many cases superior to that which can be obtained with the best of dyes, the fastness to crocking does not in all cases meet the requirements of quality needed by the use for which the cloth is intended and to which the trade has been accustomed. This brings us back to the statement we made at the start and which is fundamental in properly understanding and evaluating the limitations of this method of coloring textiles. And this is that decorating textiles with this type of coloring matter does not bear any relation to the art of dyeing or printing except in the final visual results, and that it is more closely allied to the art of painting, with this difference that while paints are usually applied to fixed and stationary surfaces subject to very limited flexing and rubbing if any, when pigments as such are applied to cloth the binder film in which they are embedded and which holds them glued to the fibers is expected, in the nature of things, to stand much more flexing and rubbing without cracking, pealing or disintegrating. It is clear that there is a limit to how far this disintegration can be held back under all conditions and stresses to which a piece of cloth is normally and abnormally subjected.

Does this mean that pigments should not be used at all for this purpose? Far from it. It means only one thing. It is up to the dyer and printer to use his experience and intelligence to evaluate all the facts entering in the composition of a decorative pattern, its processing and finally its intended or expected use, and then decide if the use of pigments will meet the required standard of economy and quality. If it does, and in many, many cases he will find that it does, there is no reason why he should not use pigments in preference to other coloring matter.

DISCUSSION

Howard V. King, chairman, presiding

Q. Can you express an opinion on the differences of color yield?

A. Referring to pigment dyeing and printing "color yield" is not the appropriate term. More appropriate would be to say "hiding power." There may be a definite difference in hiding power due, not only to the size of the particles of the pigment itself, but also to the nature of the binder and medium of dispersion. The finer the particles of the pigment are, the more surface they can cover. If the binder forms an opaque film, it more or less is going to dull the pigment. If the binder forms a perfectly clear

film the dulling of the pigment is not going to be so extensive.

Q. Do you feel that the same coverage, then, can be obtained with a water dispersion as with an oil dispersion?

A. I think so, if the binder used in a water dispersion forms as clear a film as the binder used in an oil dispersion. At this point it is important to note that when an oil in water emulsion of the binder is used the pigment should not be left in the water phase, but should be kept in the oil phase. If the pigment is in the water phase, when the water by capillary attraction is absorbed into the cloth will carry with it some of the pigment, and only part of the pigment will be left on the surface of the fibers imbedded in the binder. This of course will reduce the coverage noticeably. This mistake is often made in the preparation of this type of emulsion, and I think it is the principal reason why some people think that a water dispersion does not yield the same hiding power as the oil dispersion.

Q. Do I gather from your paper that you are making application on plain shades— khaki, and so forth?

A. Sometimes. Not all dyeings can be done with pigments. I did not intend to convey the idea that the pigments are going to take the place of all dyestuffs or supplant them. If anyone thought that he is far off the track. Pigments are going to be an adjunct to other dyes. In some cases they can be substituted for other dyestuffs with excellent results. In others they are out of place.

Q. Do you find that the finishing with resins of goods printed or dyed with pigments will increase the fastness to rubbing and washing?

A. Yes. By superimposing a properly plasticized film of water insoluble synthetic resin it is possible to impart an extra protection against crocking to pigment dyeings and prints.

Q. In applying the pigments have you tried to put them on gray goods as well as the bleached?

A. Tarpaulins, canvas and tent material are all done on gray goods.

Q. Is that a water dispersion?

A. No. It is a solvent dispersion. The water dispersion gives you a dyeing very similar to a chambray—white threads mixed with dyed surfaces. When you dye a piece of gray goods, you get about the same effect.

Q. I was just coming to that. Do you feel that that is due to the surface tension of the gray goods causing the particles to conglomerate?

A. No. I do not think this is due to conglomeration of pigment particles, but mostly to impurities and waxes in the crude fibers which do not allow the pigment to spread evenly in a continuous unbroken film. Like when you spread water on an oily surface, the water does not spread in a continuous film, but collects into droplets.

Q. I find that on gray goods there is more of a tendency for that conglomeration to take place; and I was wondering if that was due to surface tension.

A. It is due to the presence of waxes and impurities in the cloth which do not let the water dispersed pigment spread in a continuous film.

Q. Might not that be due to the starch?

A. In using a water dispersion pigment you would not have any difficulty as far as starch is concerned.

Q. Can you name some uses where fastness to rubbing is not so important? Would camouflage dyed or printed cloth be one of these?

A. Yes. Here is a sample of a camouflage net of which quite a few million yards have been done for the Marines. This is all pigment, both on cotton and on rayon.

Q. Do you get as good results on rayon as on cotton?

A. Yes—on cotton and on viscose rayon. You do not get as good results on acetate rayon.

Q. In relation to this crocking proposition, do you feel that there can be any improvement made on that?

A. We are doing all we can to try to improve it, but how far we will succeed I don't know. As far as the water soluble binders are concerned, the only hope is that we succeed in blocking the internal hydroxyl groups. As far as dry crocking is concerned, there is always going to be a degree of crocking. No matter how good a paint is, if you scratch it enough you will get it off; and these pigment dyeings and prints are paints. In any orthodox dyeing the color penetrates the fiber and by physical or chemical attraction is kept there—but in pigment dyeing or printing the pigment is absolutely separated from the fiber. It has nothing to do with the fiber. The only thing that keeps it there is the binding agent, the film. So if you scratch long enough to disintegrate this film, the pigment will come off.

Q. How far can you carry down the dispersion size?

A. You will have to ask a pigment manufacturer about that. I don't know just how far they can carry the fineness of the particles.

Q. Then it is a pure surface phenomenon?

A. Yes.

Q. Isn't it true if you have your pigments ground finely you change the color reflective properties?

A. Yes, that is true. The finer the pigment is, the more light it reflects; and the shade and brightness of the color is changed.

Q. Have you found that in general mineral pigments can be incorporated successfully?

A. Not as successfully as the softer organic pigments, but in some types of work the fineness of the pigments is not so important. The organic pigments are precipitated pigments and can be ground very fine.

Q. The coarser the pigment, the more crocking you are likely to get?

A. The coarser or harder the pigment the rougher the surface; and the rougher the surface, the easier it is to scratch it and mess it up.

MILDEWPROOFED COTTON FABRICS*

LT. JOSEPH E. GOODAVAGE
Research and Development Staff, Philadelphia Quartermaster Depot

THE global nature of this war, reaching as it does from the extreme cold climates of the frigid North to the other extreme, i.e., the Tropical regions, has created a demand on the Q. M. C. for tremendous quantities of clothing and equipment designed primarily for the comfort and welfare of our fighting forces, most of which equipment is unique in the history of the Q. M. C., and it is necessary that it remain in a serviceable condition for at least the duration.

Damage in the Tropical zones to materials containing cotton is becoming a major problem, due to the destructive action of fungi (or molds) and it is necessary that all such equipment be properly protected by being made mildew resistant. Considerable damage is created by molds growing in conduit boxes of telephone and electric lines, the inside of which appears a solid mass of growth, resulting in a grounding of the circuit. It is necessary to keep silica-gel in such boxes in order to lower the humidity and thus suppress mold growth. Molds also find their way into such instruments as range and direction finders and actually attach themselves firmly to the inside of the lens of such equipment and, when removed, leave markings which appear to have actually etched the glass, requiring a polishing with rouge to remove the defect.

In order to preserve fine cotton goods, such as uniforms, etc., they must be kept in a metal closet in which an electric light bulb is kept constantly burning to lower the humidity and suppress mold growth. Leather goods, when left unprotected, go completely to rot within a very short time.

MILDEWPROOFED COTTON FABRICS

The subject matter of this presentation pertains to a brief description of some microorganisms that are responsible for the "mildew" found on cotton fabrics, and the compounds and methods used to prevent such growths.

The microorganisms responsible for mildew belong to the family of plants known as the Tallophytic plants; plants without distinction of root, stem or branch, destitute of chlorophyl and deriving nourishment wholly, or almost wholly, from organic compounds.

This includes such microscopic plants as bacteria, yeasts, and the molds. Botanically speaking, the term mold is not the proper scientific division. It is a common English word, quite generally understood, even by those who are unfamiliar with scientific Botany, and is quite practical for our purpose. In our discussion the term mold and fungus will be used interchangeably.

Without going into the botanical sub-division of molds (fungi), in brief, we shall simply group together as molds all types of fungi which produce white felted threads which have the power of growing in or upon organic materials.

Molds in general, while they appear similar in structure, differ in many respects,—in the fineness of the threads of which they are made, in the rapidity of their growth, in the materials on which they grow, and more particularly in color; while most of them are white at first, they later show many colors.

STRUCTURE OF MOLDS

Pencillium Glaucum

The most common variety of mold, one which nearly everyone has seen at some time or other, is the one which at the time of fruiting becomes a bluish-green color and hence is called blue mold (*P. Glaucum*). This species is the one commonly found on bread and cheese; will occur on textiles, leather, and many other organic materials. When a young mold has begun to produce its fruit, it is found to consist of a long, highly branching thread (hypha). When it begins to grow, all that can be seen is this tangled mass of delicate threads. The threads, as a rule, are so minute that they are barely large enough to be seen by the naked eye and, in many cases, are so small as to be barely visible with a lens. The thread of the blue mold is too small to be seen except under a microscpoe. In some species of mold the threads grow into a very dense, felty, rather tough, mass. In other species they may form a loose mass of coarse fibers.

As these threads grow, they can penetrate into the depths of the material upon which they are growing. When growing upon any soft food material, the extent to which these threads can penetrate will depend upon the toughness or firmness of the material. The mold threads, though visible only on the surface, really extend into the substance for a considerable distance. The single thread is known to biologists by the term Hypha, collectively as Mycellium. The young mold is a loose, white mass of Mycellium but, as it grows older, it becomes denser by a continuous branching of the thread.

*Presented at meeting, Philadelphia Section, April 30, 1943.

Spores

After a few days, usually two or three, the surface of the mold usually shows some color, either blue, brown, red, or black. The appearance of the color on the surface indicates that the plant is fruiting,—that is, producing spores or reproductive bodies. The spores of different species of mold are produced in quite different ways and biologists usually classify molds by their method of forming spores. In the common blue mold, the spores are produced as follows: After the Mycellium has grown for some time, there arises from its surface tiny threads, growing vertically into the air. These threads, after extending for a further short distance, divide into little branches, several branches arising from a single stem. After these branches have grown for a short distance, they begin to be divided by slight constrictions, like rings, around them, so that each one of them looks like a string of beads. These rings cut deeper and deeper into the branch, until finally, it is broken up into a string of a dozen or more small round balls.

These little balls are the spores. When seen under the microscope, they appear quite transparent but, when a considerable number of them are seen together, they have a bluish tinge. The spore bearing branches spring up in thousands all over the mold and, after a few days, its surface is covered with a mass of thousands of spores, until the entire surface finally becomes covered with a well-known shade, spoken of as a blue mold. These spores are extremely light and are easily blown about by the wind and readily float in the air. Every breath of air striking the mass of molds in full fruit will detach some of these minute spores and blow them away.

Mucor

Another mold which forms spores in an entirely different manner is called Mucor. This produces its spores inside of little sacs, which are borne on long stalks. The Mycellium in this mold is coarse and the threads are easily visible, making a loose matt of delicate fibers and some times grow an inch or so in thickness. When ready to fruit, threads grow vertically into the air and the end of each thread soon swells into a small rounded knob. This knob continues to grow until it becomes a ball of considerable size, at first white, but finally black, and large enough to be seen with the naked eye. Inside this ball living substance of the plant soon breaks up into hundreds of minute bodies. These are the spores, and, after they have become formed, the sacs which hold them (Sporangia) burst and the little spores are thrown out and blown about by the wind. These molds are at first white, but later black, from the abundance of these spore sacs.

Aspergillus

Another very common sort of mold is Aspergillus. A fine threadlike Mycellium is produced, as in the other cases, and, from it grow the fruiting branches. At the end of each fruiting branch grow a small round ball, from all sides of which project many little knobs. These knobs lengthen a little but soon break up into round spores,—very much like the branches of blue mold. The result is that, since they protrude in all directions, there appears on the end of each fruiting branch a little rounded mass, looking very much like a flower. Each ball is a mass (of scores) of spores. Some molds of this type produce brown spores instead of white.

Germination of Spores

Spores are resting stages, which are very resistant to unfavorable conditions. When favorable conditions are present the spores may germinate—develop into the active growing stage. This involves, of course, the rupturing of the outer wall with often an extrusion of a inner wall. Finally, a thread-like structure is formed and the plant is ready again to reproduce these steps. When a spore lights upon any material, e.g., a textile fabric, it remains there in a latent form, if conditions are unsuitable for its development.

It is possible then for raw cotton to pick up spores while it is still in the boll and growing in the field. Later, whenever conditions are suitable, whether the cotton is in the field or in any of the operations of yarn or cloth manufacturing, these spores can start growing and produce what we commonly know as "mildewed cotton." When "mildewed" raw cotton is mixed with other cotton (free from mildew) and processed into yarn, and finally into a fabric, on dyeing "specky" results are obtained; the mildewed cotton usually dyes lighter and behaves in dyeing somewhat like "dead" or unripe cotton.

Conditions Necessary for Mildew Growth

The conditions necessary for mildew growth are:
Food (Nutrient), Moisture, Proper Temperature.

Colorless plants, such as molds and bacteria, are, like animals, obliged to have organic substances for food, and, therefore feed upon materials essentially similar to those which form the food of animals, i.e., proteins, fats, sugars, etc. Since colorless plants and animals require the same kinds of food, they become rivals in nature. The green plants, on the other hand, living upon totally different foods, are in no sense the rivals of animals, but their allies. It is this fact, their living upon organic matter, that makes the colorless plants of considerable good, or they may be the cause of considerable damage, to plant growth, food, or textile material.

Water and oxygen are necessary for growth of fungi and, in addition, the following elements are known to be required—carbon, nitrogen, potassium, phosphorus, sulphur, and magnesium. In addition, many require, or grow very poorly in the absence of iron. Opinions vary as to the necessity of a few other elements but, if they are required, the amounts are so minute as to make special

provision of such unnecessary in culture media. Most of the common molds can utilize inorganic sources of all the elements, except carbon, but a few are unable to use inorganic nitrogen. Others grow well on media containing ammonium salts but cannot utilize nitrogen from nitrates. However, the great variety of natural substrata which are commonly infected by numerous species of molds indicates that these organisms can tolerate wide variations in concentrations of the essential elements and can utilize both carbon and nitrogen combined in very diverse forms.

The ability of certain molds (fungi) to utilize the carbon from various sources serves as an important link in supplying different kinds of living things with food. The woody part of trees contains a large amount of material which cannot be used as food by either plants or animals. Were it not for some agent which brings this material into condition for subsequent use by plants and animals, much of the food material of the world would be stored away in the form of wood, and the world would materially suffer as a result. But the tree trunk does not remain a hard, solid mass very long after it has fallen to the ground. It slowly softens and decays, until eventually it assumes a condition in which it can again be used for food by various plants and animals. Insects for example, feed upon decaying wood, and in time consume it all. In this process, a group of fungi, similar to molds, plays an important part, for it is a mold—like mycellium growing through the hard surface of the wood that begins the softening necessary to make this utilization possible.

The ability of certain fungi to convert the carbon of cellulose into a readily assimilable food can result in the complete destruction of cotton materials. Under Tropical conditions, this can take place in a comparatively short time,—from 5 to 7 days, especially if the cotton material is in contact with the soil, which in the tropics is usually teeming with micro-flora organisms, where the cotton would be at the mercy of molds, enzymes, and bacteria.

In addition to the cellulose destroying types, it is just as important to protect cotton materials from the surface growing types, such as Pencillium and Aspergillus, which discolor the cotton material and impart to it an objectionable musty odor. Such musty odor is due to the products of decomposition, brought about by what we know as "mildew" and also caused by the spores permeating the air we breathe and which we can actually taste.

For the complete protection against mildew it is necessary that the environment of the fabric is such that it inhibits the growth of Chaetomium Globosum, Metarrizium, Aspergillus and Pencillium; the first two being active cellulose destroyers, the other two the surface growing types, all of which are representative of the types found in the tropical and temperate climates; requiring as they do different types and amounts of food; varying amounts of moisture, and capable of existing under a wide variation of acidity.

In order to meet these requirements it is necessary that the mildew inhibitor be more than just an ordinary antiseptic, it must have fungicidal properties, i.e., a compound which is toxic to fungi.

The ideal mildewproofing agent, if one could be had, should possess the following properties:

a. It should be soluble in water, having an affinity for cotton, somewhat in the manner of a direct dye.

b. It should be colorless.

c. It should have fair fastness to leaching.

d. It should be non-toxic.

e. It should be free from any objectionable odor.

f. It should be an effective fungicide.

g. It should not have an injurious action on cotton, even under prolonged exposure to weather.

While it must be admitted that, at the present time, such a compound appears to be far-fetched; moth-proofing went through about the same stages as our present mildew problem is going through today; the moth-proofing of wool has settled down to a few compounds which are easily applied and, evidently, are effective.

At the present time, the following fungicides are being applied on cotton materials to meet the mildewproofing requirements of the Philadelphia Quartermaster Depot:

Phenolic Derivatives:
Ortho-phenyl-phenol
2-chlor-o-phenyl-phenol
Penta-chlor-phenol
Tetrabrom-o-cresol
Salicylanilide
2,2-dihydroxy-5,5-dichlor-diphenylmethane.

Naphthenic Acid Derivatives:
Copper Naphthenate
Zinc Naphthenate.

Zinc Organic Compounds:
Zinc Dimethyl Dithic-carbamate.

Copper Compounds:
Copper Oleate.

Cuprammonium Compounds:
Cuprammonium Hydroxide
Cuprammonium Fluoride.

Mercury Compounds:
Phenyl Mercury Acetate
Phenyl Mercury Oleate
Phenyl Mercury Trinitriloethanol Lactate.

Quaternary Amines:
Alkyl Dimethyl Benzyl Ammonium Salts
Cetyl Pyridinium Chloride

Organic Amines:
Amino-guiacol Benzo-thiazole Imino-urea.

THE APPLICATION OF FUNGICIDES

The following methods are in use for the application of fungicides:

1. *The solvent Method*—In the method the fungicide, which is usually a phenolic derivative or a naphthenate, is applied by means of an organic solvent, such as alcohol, or a mixture of dry cleaning solvents, together with a solvent type repellent. This method yields the most durable type of treatment but, unfortunately, due to the fire hazard, toxicity, and volatility of such solvents, few, if any, textile plants are equipped for this type of application. Plants applying rubber or synthetic resin to cloth are well equipped to handle this imethod.

2. *Precipitation*—By this method the water soluble salt of the fungicide is first applied to the fabric and, by passing into an acid bath, the insoluble form of the fungicide is precipitated in the fabric. This second operation is usually carried out in the acidified water repellent solution made acid with acetate acid. Because of the two operations required, this method is not favored by many in the industry. When properly applied by this method, the fungicide treatment is next in durability to that of the solvent method.

3. *The Single-Bath Method*—From the point of application, this is the simplest and least costly method of applying fungicides and consists of applying the fungicide and the water repellent simultaneously in one operation. This is carried out by making a fine suspension of the insoluble fungicide in the water repellent and passing the cloth through a diluted solution of such a preparation. The durability of such a treatment depends to a large extent on the character of the water repellent and also on the degree of dispersion and the particle size of the dispersed fungicide. While this is the least costly method, it some times becomes the most troublesome.

An illustration of the difficulty encountered by this method was that which took place in the finishing of a netting, using pentachlorphenol applied from a single bath. In the mill difficulty was encountered from time to time in that the inspector's samples submitted failed to pass the leaching test. Investigation at the plant showed that they were making two different types of netting, both finished with an identical formula for mildewproofing and water repellency. One type was dried on a "cold frame" and this, in all cases, passed the leaching test; the other type, dried on a tenter frame, at times failed to pass the leaching test.

A sample taken from one lot that was rejected for the leaching test was put in the Depot's Laboratory oven and heated for one hour at 100°C. This sample passed the leaching test and also showed a considerably lower percentage of absorbency in the water test.

The conclusion arrived at from the above test, is that, when a material treated with a water repellent is subjected to an initial high temperature, a "skin effect" is produced, resulting in a drying of the outside of the coated fibers and leaving the inside in a somewhat pasty or undried condition, which evidently is responsible for the poor resistance to leaching. The unevenness in drying is probably due to the difference in the physical characteristics of the stabilizing gum or resin when compared to the other ingredients comprising the water repellent.

Another difficulty brought to the attention of the Depot was the apparently poor results obtained from a single-pentachlorphenol-bath on a braided, cotton covered elastic cord. In this plant the material was processed very carefully, following in detail the instructions of the jobber who sold the compounded water repellent. A sample cord, so treated, failed to pass the accelerated mildew test.

Analysis of the pentachlorphenol content showed less than .05 per cent retained, instead of the ½ per cent that is ordinarily required for mildew resistance. Investigation at this plant showed that the "pick-up" was exactly as calculated but, unfortunately, most of the pentachlorphenol had settled out of the emulsion and the braid was simply picking up the water repellent and very little of the fungicide.

All of the mentioned inhibitors when properly applied meet the performance requirements. Some are more dur-
type, dried on a tenter frame, at times failed to pass
teristics, are limited in use.

Such a fungicide is copper naphthenate, whose effectiveness to both "rot" and "mildew" resistance is so outstanding that it is often used as the yardstick in evaluating the efficacy of other fungicides. Unfortunately, since it imparts color and has a rather penetrating odor, characteristic of Naphthenic Acid derivatives, its application at the present time at the Philadelphia Quartermaster Depot is limited to such items as webbing and rope. Zinc Naphthenate, which is also an effective fungicide, but not to the extent of the copper compound, has little color of its own (almost colorless) but has about the same characteristic odor.

Both the Zinc and the Copper Naphthenate can be compounded with coal tar residues and pigments to yield Olive Drab Shades of good fastness to weathering, especially when used in conjunction with a water repellent and applied by the solvent method. Water emulsions of both the copper and the zinc compounds can be obtained.

A number of phenolic derivatives are also efficient fungicides but, from the point of durability they do not compare with the naphthenic derivatives in the burial test. They meet the requirements of the accelerated mildew test when used in conjunction with a water repellent, which aids in retaining them on the fabric. One of which is Pentachlorphenol, the efficiency of which is increased considerably when used by the two-bath method. Unfortunately, this compound, while it inhibits the growth of cellulose destroying molds and the surface type molds, is

classified as an irritant and, therefore, is limited in its application to materials other than those that come into "intimate" contact with the body. Work carried out to determine its stability to weather indicates that, while there is a slight increase in the pH, showing an increase in acidity when exposed to weather conditions, the increase does not warrant the condemnation of this product.

The dihydroxy-dichlor-diphenylmethane compound is outstanding as a phenolic derivative in that it is an efficient fungicide, inhibiting all types of mold growth. It is considered non-toxic and, therefore, can be applied to all types of cotton materials, including those coming into "intimate" contact with the body.

Ortho-phenyl-phenol, which is possibly the lowest in price of all of the fungicides, is also a very effective fungicide but, unfortunately, from the practical standpoint of application, it has been found that it interferes with water repellency to the extent that it is readily removed by leaching, and more so when subjected to simulated rain conditions, such as the spray test. Another bad feature of this compound is that it actually steam distills in the drying operation. This compound is also given a clearance on toxicity and if a way could be found to anchor this material in the fabric so that it would remain there, wide application could be found for it.

The Cuprammonium compounds, especially the process in which the fabric is treated with ammoniacal solution of Copper Oxide, requires a very close control of fine textile fabrics, in order to overcome the stiffening, glazing, and actually the weakening and loss of tear strength of the fabric. While this process causes a chemical combination between the cellulose fibers and shows good resistance to the burial test and inhibition to the cellulose destroying molds, experiments have shown that common, ordinary molds, such as the Pencillium type, can grow on such treated materials, when finishing agents are added such as oils, etc. Its application is limited principally to materials that are subjected to burial or come in contact with the soil. The Cuprammonium products, including Cuprammonium Fluoride, impart color, and for this reason their application is somewhat limited. Copper Oleate also imparts color and supports surface growing molds, while it resists satisfactorily the cellulose destroying types.

Of the mercury compounds, the outstanding one is Phenyl Mecuro Trinitriloethanol Lactate, which is considered non-toxic when applied to the extent of .4 per cent on the fabric. While it is claimed that this compound undergoes a change when subjected to the drying operation to the extent of becoming faster to leaching, no work has been carried out at this Depot to support this claim. While the Phenyl Mercury Acetate and Oleate derivatives are classified as irritant compounds, they also can support surface molds.

The Quaternary Amine compounds, of which there are a number available as antiseptics and fungicides are among the latest to be developed. They are efficient compounds and in some cases have been shown to have substantive properties capable of resisting the spray and leaching tests, being colorless and water soluble though in some cases the solubility is too great, necessitating an after-treatment to decrease their solubility in order to render them more durable.

Organic Amines—The Amino-guiacol benzo-thiazole Imino-urea, which compound is wholly of an organic nature, with no metal present, is compatible with water repellents, and is being applied to materials both animal and vegetable types, indicating that it is an efficient bactericide and a fungicide.

From observation of the field of fungicides as presented today, it appears that a compound in order to be an efficient, all-round fungicide must have a slight degree of solubility and be toxic to fungi. While the insoluble type of inhibitors are firmly combined with fiber, e.g., Cuprammonium, its solubility being practically zero, while it shows good resistance to the burial or rot test, as a fungicide it does not compare for example to pentachlorphenol.

Where the solubility of a compound increased, its leaching properties increase and, as a result, it is not as durable as those with a very low solubility. Materials which are required by the Phila. Q. M. Depot to be water repellent and mildew resistant are subjected to a performance test. This performance test consists of:

1. A modifying test.
2. The accelerated mildew test.

The modifying test, depending upon the type of material, is either a leaching test or a spray test. The leaching test is carried out as follows:

A sample of netting 6 x 12 inches is immersed in one gallon of water; temperature 65°F. The flow of water is then regulated so as to change the water three times over a period of 24 hours, after which the sample is sterilized and then inoculated for the accelerated mildew test.

The spray test, applied to materials used in the out-of-doors and which are subjected to rain and weathering, is carried out as follows:

A sample is mounted on a board which is placed at a 45° angle. The sample is then sprayed for one-half hour with water from a spray nozzle placed vertically above the sample at a distance of 18 inches from the center of the sample. The volume of water sprayed onto the sample shall be approximately 2000 c.c. per minute per 60 square inches of sample. The spray nozzle shall contain 19 holes of .035 diameter, spaced approximately ½ inch apart.

For each sample submitted one portion is inoculated as received; another portion is sterilized and inoculated; while a third portion is subjected to a modifying test, either the leaching or the spray test, then sterilized and inoculated. In addition, a control sample of plain cotton fabric is inoculated. All four samples are then incubated

in a special room where a temperature of 80°F. is maintained with a relative humidity of 85 per cent.

The organism used in the test is Chaetomium Globosum and the period of incubation is 14 days. The nutrient is the one developed by Thom of the U. S. Department of Agriculture, the pH of which is between 6.8 to 7.0. If no growth is visible after 14 days, the sample is considered as passing the test. In case of a disagreement breaking strength tests are carried out on an average of 10 exposed and 10 unexposed samples.

It is customary for a contractor before starting production to submit a sample of a mildew resistant fabric. After the fabric has been subjected to the performance test, the contractor is notified of the outcome. If the outcome of the test is satisfactory and the treatment acceptable to the Depot, it is then understood that the contractor shall use the same mildew inhibiting process during the life of his contract. If for any reason a change is to be considered, he must notify the Depot. It is also a requirement of the Depot that the nature of the fungicide employed and the approximate amount retained in the fabric be made known at the time the sample is submitted.

At this time I would like to acknowledge the fine cooperation that the Philadelphia Q. M. Depot is getting from the various manufacturers of mildew inhibitors and I, personally, wish to extend my appreciation, especially to you men who contact the man who applies the fungicide,—may I say "Many thanks" for the wonderful job you are doing.

MEETING, MILDEWPROOFING SUB-COMMITTEE

AT the January meeting at Boston it was proposed that perhaps the initial work of the Mildewproofing Subcommittee should be an attempt to prepare a Federal Specification on mildew- and rot-resistance tests. Following up this suggestion, those of us who could conveniently do so got together at an informal meeting and agreed that we did not have enough strictly comparable data on the various tests that are now in use to formulate a Federal Specification, but that we might attempt to formulate a "proposed Federal Specification." The Chairman of the Textile Committee on Federal Specifications, W. D. Appel, agreed to appoint a sub-committee to prepare and submit to him such a proposed Federal Specification. This is far enough along that the rough draft was presented to the Sub-committee at the New York meeting April 16. It was approved in principle by the Sub-committee. It was also agreed that we should appoint a sub-committee to get together a number of representative treatments and apportion subsamples to various interested laboratories for testing reproducibility of suggested methods and to guide us in eliminating methods that have no particular merit, in the hope that we can shortly set up A.A.T.C.C. standards of testing procedure. Richard D. Wells, Research and Development Section, Quartermaster Corps, Washington, D. C., was appointed chairman of the sub-committee on standard samples. Laboratories interested in co-operating in testing procedures were requested to notify him.

The following attended the meeting: C. B. Armstrong, General Dyestuff Corp., New York, N. Y.; R. E. Rogers, Bureau of Human Nutrition and Home Economics, Beltsville, Md.; I D. Dean, Bureau of Agricultural and Industrial Chemistry, Southern Regional Research Laboratory, New Orleans, La.; Capt. Harald Flaata, Corps of Engineers, Washington, D. C.; Francis Tripp, New Bedford Textile School, New Bedford, Mass.; A. C. Goodings, Ontario Research Foundation, Toronto, Canada; R. J. Cheatham, Bureau of Agricultural and Industrial Chemistry, Washington, D. C.; Lt. J. E. Goodavage, Philadelphia Quartermaster Depot, Philadelphia, Pa.; Elmer C. Bertolet, Engineering Division, Jeffersonville Quartermaster Depot, Jeffersonville, Indiana; R. D. Wells, Office of the Quartermaster General, Washington, D. C.; V. L. Shipp, Socony-Vacuum Oil Co., New York, N. Y.; O. B. Hager, Rohm & Haas Co., Philadelphia, Pa.; William A. Stringfellow, Ciba Company, Philadelphia, Pa.; C. F. Shoemaker, Ciba Company, New York, N. Y.; R. H. Souther, Proximity Print Works, Greensboro, N. C.; H. D. Barker, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Dept. of Agriculture, Washington, D. C.

H. D. BARKER, *Chairman*

SUB-COMMITTEE ON TEXTILE FINISHES

THE Research Committee has established a sub-committee on Textile Finishes under the chairmanship of Kenneth H. Barnard, Director of Product Research of the Pacific Mills.

Membership in this sub-committee will be limited to qualified chemists who are experienced in the field of finishes, and they will receive the benefit of the information which is derived from the rest of the members only to the extent of their personal contribution to this work.

At a recent meeting of the sub-committee, its agenda was established and will embrace the qualitative and quantitative determination of the newer synthetic finishes to include water repellents and mildew treatments. This is in line with the request of Colonel Steadman of the Quartermaster Corps for methods to determine the amount and character of Thermo-plastic resin, water repellent and mildew preventative finishes which are encountered in typical fabrics in use by the Army. The Committee's first assignment is the development of a suitable technique for the handling of each of these subjects on which there is very little published information.

Selected samples of fabrics which contain a known quantity and quality of synthetic finish will be distributed among the Committee members to be subjected to interlaboratory tests according to preliminary methods which

have already been discussed. The results will not be published until sufficient progress has been made to permit the setting up of provisional standards and methods. So far, very little has been done in this field, but much can be accomplished, and it is hoped that this Committee will be able to render a valuable contribution to the Textile Industry.

REPORT, NORTH CAROLINA STATE COLLEGE STUDENT CHAPTER

THE North Carolina State College Student Chapter is still carrying on, but the ranks are being pretty well depleted. During the past few weeks, many of the Junior class members have been taken by the armed forces. Included in the list are John M. Culp, G. R. Kuhn, John Pharr, and James McAlister (our Secretary). Ed Grosse and B. Kuwaski of the Senior class also have been called. Most of the Senior class members have been permitted to stay in school to graduate in June.

The Chapter had a guest speaker recently, who spent an entire day with them lecturing and demonstrating. He was W. C. McMann of E. F. Houghton & Co.

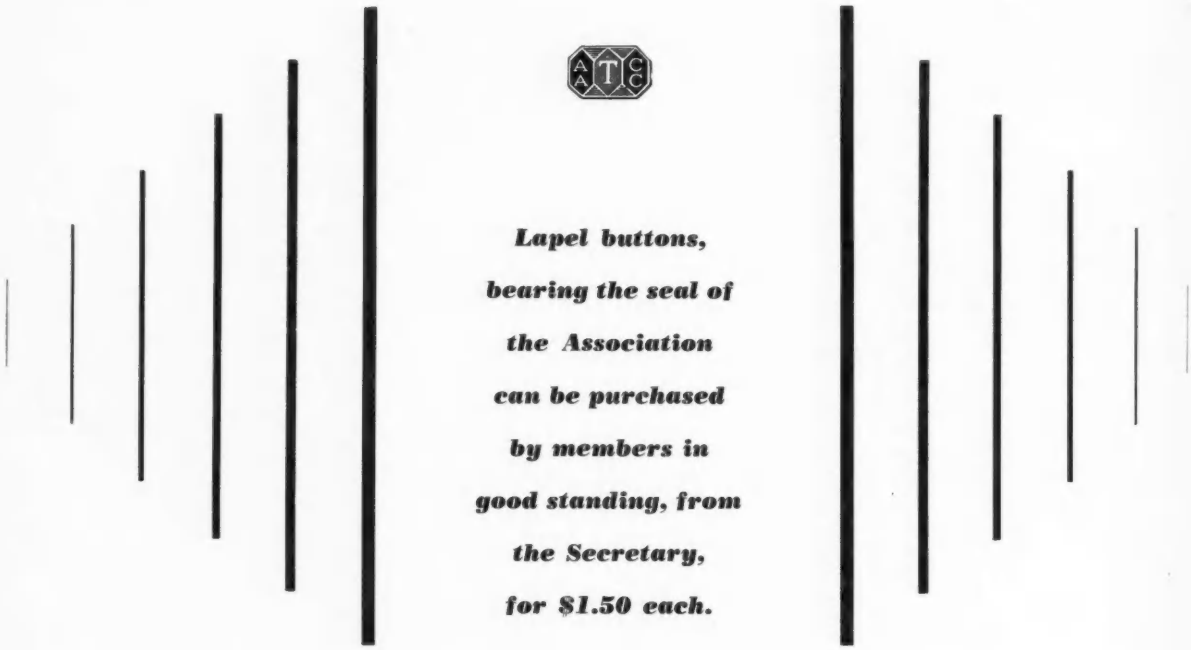
Mr. McMann was for twenty-nine years in charge of Bleaching and Finishing at the Riverside and Dan River Mills. He gave a very fine prepared talk in the form of a lecture and discussion concerning the preparing of cloth, scouring, and bleaching. The lecture was accompanied by blackboard sketches of layout of machines.

In the afternoon talk, Mr. McMann explained how and why various machines and chemicals were used. He gave in detail the uses of some of the commercial assistants, and demonstrated the uses of some of his firm's products.

The Student Chapter members were much impressed with his knowledge of his work, and invited him to come back again soon for further lectures.

Respectfully submitted,

W. R. IVEY, *Chairman*



Lapel buttons, bearing the seal of the Association can be purchased by members in good standing, from the Secretary, for $1.50 each.

OBITUARY

WALTER SAENGER

WALTER SAENGER, 59, Vice-President of Geigy Company Inc. and President of the Bayonne Company Inc., died suddenly of a heart ailment at his home 39-44 222nd Street, Bayside, N. Y. on Sunday, May 16th. The funeral was held from his home on Thursday, the 20th, and interment was private.

Mr. Saenger was born on July 18th, 1883 in Bienne, Switzerland. He attended school in Switzerland, upon completion of which he served apprenticeships in Basle, Switzerland; Palermo, Sicily; and London and Manchester, England. He joined the staff of J. R. Geigy, S. A., Basle, Switzerland in the year 1911. After a short training period, he was assigned as representative of that company in Calcutta, India where he served for two years, after which he became affiliated with the New York organization, Geigy Company Inc. in 1914.

When World War I broke out he was called to the Swiss colors but returned to the States shortly after on a special leave. He acted continuously from that time on as Vice-President and Treasurer and latterly as Vice-President of Geigy Company Inc.

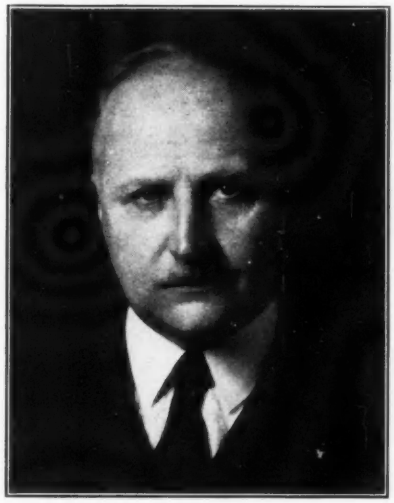
Mr. Saenger was an accomplished linguist, being a master of the various Swiss dialects, English, French, German, Italian and some of the Arabic dialects, besides being an authority on history and geography and Americana.

Mr. Saenger was an enthusiastic equestrian and well after he was past 45 his horsemanship attracted polo enthusiasts. He was prevailed upon to take up the game and for the short period of time devoted to that strenuous sport he made a most creditable showing.

Mr. Saenger was active in the organization of the Olympic games in Lake Placid in 1929, was a member of the Advisory Committee of the Swiss Pavillion Restaurant at the World's Fair and was responsible for bringing over the very striking Fife and Drum Corps from Basle, Switzerland.

He was deeply interested and enthusiastically participated in the activities of the Swiss societies of New York where he served in many capacities. His benevolences were known to many needy and stranded.

Mr. Saenger was married in New York on November 10th, 1915 to Alice L. Grill who survives him as do three sons, Werner, now in the Coast Guard at Kitty Hawk,



Walter Saenger

N. C., Robert, now in the Air Corps, in Mississippi, Albert, and a daughter, Marguerit Saenger Forster. His clubs were: The Swiss Society of New York, The Swiss Benevolent Society, and Downtown Athletic Club.

Mr. Saenger was a director of Cincinnati Chemical Works, Inc.; of Geigy Company Inc.; and Bayonne Company Inc.

FREDERICK KERSHAW

FREDERICK KERSHAW, president of Proctor & Schwartz, Inc., Philadelphia, Pa., died recently at his home after an illness of several weeks. He was 58 years old.

Mr. Kershaw had been associated with the firm of Proctor & Schwartz since 1898. He left the firm in 1907 to attend college and was called back to the firm to fill an important position before he graduated.

Mr. Kershaw attended St. Paul's Episcopal Church, Chestnut Hill. He was a member of The Rotary Club of Philadelphia, The Philadelphia Country Club, The Union League, The "Wolves and Lambs" Club and the Mayfair Club.

Mr. Kershaw is survived by his widow and two daughters.

• DYES FOR USED APPAREL

Commercial dyers can now get all the dyestuffs and organic pigment required for dyeing used apparel and used housefurnishings without adhering to a quota restriction, under Order M-103 as amended by the War Production Board.

This action, which is in the form of an exemption from the order for redyeing of used garments and household furnishings, was taken because it was found that the former restrictions resulted in very little conservation of dyestuffs. It was also felt that a conservation of materials will be effected by the amendment since used clothing and household furnishings are frequently discarded if not redyed.

The amended order also includes an exemption for food, drug and cosmetic colors, which is really a reinstatement of the exemption as it appeared in the original provisions of M-103, but was later eliminated. About 50 per cent of the appeals received by WPB under this Order have been in this category and it was the unanimous opinion of the Department of Agriculture, the Food and Drug Administration and the Drug and Cosmetic Branch of WPB as well as the Textile, Clothing and Leather Division that this exemption be reinstated and that unrestricted sales and deliveries of dyestuffs and organic pigments for this purpose be allowed.

Another exemption contained in the amended order permits unrestricted sales and delivery of any dyestuffs and organic pigments to any person for medicinal, therapeutic and diagnostic uses and for chemical indicators and bacteriological stains, which involve a negligible amount of dyestuffs.

Unrestricted sales and deliveries of these dyestuffs and organic pigments to or by a retailer will be in packages of eight ounces or less. Any quantities above that can only be purchased or delivered upon the required certification by the purchaser called for by Order M-103.

The amendment was effective May 24, 1943.

• COOPERATIVE INDUSTRIAL RESEARCH

On Thursday, May 27, the Board of Directors of Textile Research Institute, Inc., unanimously approved plans for a five-point program of cooperative industrial research. The Directors also approved a $2,000,000 fund-raising project to support the program.

Announcement of the plans and their adoption was made by Fessenden S. Blanchard, President of the Institute, following the Board meeting at the Hotel Roosevelt.

Submitted to the Board by its Executive Committee after several months of study and development, the plans, it was stated, "are a direct outcome of the growing recognition that the technical basis of the textile industry is rapidly being revolutionized." Declaring that there is an immediate need for intensive industrial re-

search both for wartime needs and for the peace-time situation ahead, the Executive Committee stated that the program contemplated attacking both problems on a cooperative industrial basis. It was revealed that the program will be undertaken adjacent to, and in conjunction with, a recognized college or university to be selected.

In order to finance the program the Board authorized the creation of a Finance Committee to seek from the industry a fund of $2,000,000 at the rate of $300,000 a year for a five-year period, plus a capital sum of $500,000.

Members of the Executive Committee, whose report was unanimously accepted, are Fessenden S. Blanchard, Fuller E. Callaway, Jr., Robert E. Rose, Dr. Harold DeWitt Smith, Edward T. Pickard, W. D. Appel, Douglas G. Woolf and Stanley B. Hunt.

The five-point program of the Institute comprises fundamental research in all major fibers both natural and synthetic; applied and processing research in each of the major branches of the industry; economic research; a research information service and scientific training of picked graduate students. The Committee's report placed special emphasis on the last-named in recognition of the growing need in the textile industry for research men of the broadest possible training.

The Directors decided that the Institute's program should include the industry as a whole and not concentrate on any one type of raw material—whether cotton, wool or rayon. The report emphasized the tremendous growth in the use of synthetic fibers and other developments which are breaking down the barriers which once existed in the industry. The primary need today, the Directors stated, is for the broadest possible approach to the needs of the industry as a whole.

Describing the program as a "double-barrelled" one, aimed both at immediate and practical ends and at the same time giving adequate emphasis to the need for planning, preparation and action now on the evident peace-time problems to be faced by the industry, President Blanchard said that all major branches of the textile industry and their suppliers will be asked to participate in the financing and other aspects of the project.

The Institute was established in 1930 as the United States Institute for Textile Research. Its present Board of Directors consists of W. D. Appel, Chief, Textile Section, National Bureau of Standards; John Bancroft, Jr., President, Joseph Bancroft & Sons Co.; Arthur Besse, President, National Association of Wool Manufacturers; Fessenden S. Blanchard; F. Bonnet, Director, Standards Division, American Viscose Corporation; C. F. Broughton, President, Wamsutta Mills; Fuller E. Callaway, Jr., President, Callaway Mills; H. M. Chase, Director of Research, Riverside & Dan River Cotton Mills, Inc.; Earl Constantine, President, National Association of Hosiery Manufacturers; Erb N. Ditton, Director of Research, Gotham Silk Hosiery Co., Inc.; Alban Eavenson, Eavenson & Levering Co.; Russell T. Fischer, President, National Association of Cotton Manufacturers; Ephraim Freedman, Director, Bureau of Standards, R. H. Macy & Co., Inc.; H. Grandage, Vice-President, Clark Thread Co.; M. Earl Heard, Dean, Philadelphia Textile Institute; Marland C. Hobbs, Vice-President, Arlington Mills; Charles J. Huber, Development Engineer, Johnson & Johnson; J. Spencer Love, President, Burlington Mills Corp.; W. M. McLaurine, Secretary, American Cotton Manufacturers Association; Louis A. Olney, Professor, Chemistry & Dyeing, Lowell Texitle Institute; Edward T. Pickard, Secretary and Assistant Treasurer, Textile Foundation; D. H. Powers, Monsanto Chemical Co.; Robert E. Rose, Director, Technical Laboratory, E. I. du Pont de Nemours & Co., Inc.; Edward R. Schwarz, Professor, Textile Technology, Massachusetts Institute of Technology; Albert L. Scott, President, Lockwood Greene Engineers, Inc.; Harold DeWitt Smith, Treasurer, A. M. Tenney Associates, Inc.; Charles A. Sweet, Vice-President, Wellington, Sears & Co.; A. M. Tenney, President, A. M. Tenney Associates, Inc.; Albert C. Walker, Bell Telephone Laboratories; Douglas G. Woolf, Editor-in-Chief, Textile World.

• JOINS RODNEY HUNT

The Rodney Hunt Machine Company of Orange, Massachusetts, announces that Harold H. Belcher has joined their organization to take charge of engineering and development work for the Textile Machinery Division.

Mr. Belcher received his engineering degree from Massachusetts Institute of Technology, Class of 1925. Continuously since that time he has been actively engaged in machinery design for the Textile Industry. For the past two years he has been designing engineer for Proctor & Schwartz, Incorporated of Philadelphia, Pennsylvania. Previous to that he was chief engineer and secretary of Philadelphia Drying Machinery Company until this company was combined with Proctor & Schwartz, Incorporated.

• CLASSIFIED • ADVERTISEMENTS

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $6.25 per column inch or less per insertion.

WANTED: Salesman—textile chemicals and specialties. Penna. and N. J. Experienced in dyeing and finishing preferred. Write Box No. 439.

WANTED: Dyer as night superintendent of entire plant wanted by reputable, progressive jig plant, experienced on acetate and rayon men's and women's linings, flat goods, etc. Finishing and chemistry knowledge helpful but not necessary. State age, draft status, experience, references, salary desired. Our organization knows of this advertisement. Write Box No. 443, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: Hosiery dyer. With several years experience in the dyeing of silk, nylon, rayon and cotton hosiery. Also khaki half hose for the Army and Navy. Thoroughly capable of making and matching of shades. Draft status 4-H. Write Box No. 444, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

WANTED: Salesman for textile chemicals wanted by manufacturer. Some knowledge of textile processing and a following in the New England States or Pennsylvania required. Please reply by letter stating qualifications, salary desired and so forth. Write Box No. 26, Irvington, N. J.

POSITION WANTED: Textile research chemist desires position with progressive organization. Capable of handling production or technical work on cotton or rayons, yarns or piece goods. Seventeen years' experience covering all types of dyes and a wide variety of fabrics. Write Box No. 445, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

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CEGLIN*
the PERMANENT CELLULOSE FINISH
CEGLIN* is adaptable to a broad variety of finishes for most fabrics. Proper manipulation of this cellulose material makes possible a finish which cannot be duplicated with other products. CEGLIN is fast to repeated laundering. It is economically applied, not only in the conventional manner, but also before kier-boiling. CEGLIN works equally well with pigment dyes and water-repelling or mildew-proofing agents. Its use results in a lint-free product of increased strength and durability.
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Works and Principal Offices: Fredericksburg, Virginia
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FOR

WOOL

This level dyeing wool color is *faster to light* than any other Acid Red. Its good money value renders it of special interest for the production of fast to light Reds, or in combination with Alizarine Blues and Fast Light Yellows for the production of mode shades.

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Manufacturing Chemists

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ALIZACHROME BLUE BLACK B

FOR

WOOLEN AND WORSTED
OD FABRICS

ZINSSER & COMPANY, Inc.
ESTABLISHED 1897
Manufacturing Chemists
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for the Safe Processing of All Fibers and Fabrics

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In the interest of economical, efficient and safe production it will pay you to check the qualifications of Olate against those provided by the soaps or other processing agents you may now be using.

EXCEPTIONALLY LOW TITER

Rapid solubility is one of many Olate advantages. Saves time, labor, steam.

RAPID, THOROUGH RINSIBILITY

An important safety factor in processing any fiber or fabric. Olate rinses freely even at lower-than-average temperatures.

THOROUGH YET MILD CLEANSING ACTION

Olate's cleansing action is as gentle as it is thorough. There is probably no safer soap available than pure, neutral Olate—nor one with better detergent action.

STABILITY AGAINST RANCIDITY

Careful selection and refinement of the oils used in Olate—and exacting processing safeguards—make it unusually resistant to oxidation and rancidity. Coupled with Olate's free rinsing properties, this Olate advantage is an important safeguard against fabric discoloration or odor troubles.

Let this safe, efficient textile soap help smooth out *your* wartime processing difficulties.

Procter & Gamble

Olate *the universal textile soap*

DO YOU WATERPROOF FABRICS to GOVERNMENT SPECIFICATIONS?

Kali CHEMICALS

— for treating uniform cloth, tent duck, and tarpaulins include:

HYDROXY* WATER-SHIELD "D"

HYDROXY WATER-SHIELD and MILDEWPROOF NO. 1

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— for treating burlap and osnaburg for sand bags:

HYDROXY* MILDEWPROOF NO. 2

(*Reg. U. S. Pat. Off.)

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Manufacturing Chemists

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Manufacturers and Distributors of

Dyestuffs and Chemicals Soaps and Oils

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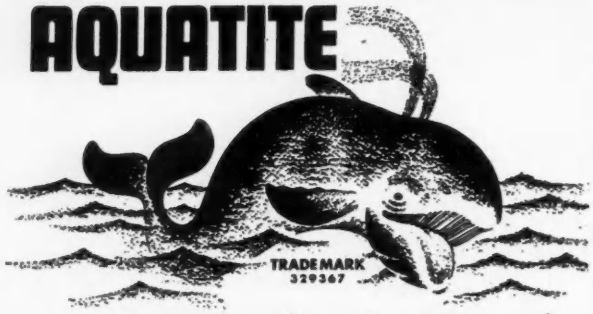
AQUATITE



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A one bath water repellent finish for hosiery, cotton duck, rayons, satins, etc., which meets exacting Government specifications as well as all civilian standards.

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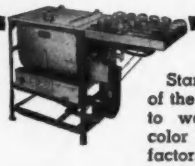

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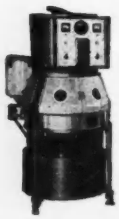

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THE year 1943 promises to be the grimmest, hardest year this country has ever faced. Every effort, and every dollar of national income not absolutely needed for existence, should go into war work and War Bonds.

In the Pay Roll Savings Plan, America finds a potent weapon for the winning of the war—and one of the soundest guarantees of the preservation of the American way of life!

Today about 30,000,000 wage earners, in 175,000 plants, are buying War Bonds at the rate of nearly half a billion dollars a month. *Great as this sum is, it is not enough!* For the more dollars made available now, the fewer the lives laid down on the bloody roads to Berlin and Tokio!

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And one thing more, these War Bonds are not only going to help win the war, they are also going to do much to close the dangerous inflationary gap, and help prevent post-war depression. The time and effort *you* now put in in selling War Bonds and teaching your workers to save, rather than to spend, will be richly repaid many times over—now and when the war is won.

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The Burkart-Schier Chemical Company, pioneer in the development and manufacture of wet processing agents for yarns and piece goods, is playing an active part in this vital work. For Burkart-Schier chemists and textile chemicals are working right along with America's mills, helping to scour, mercerize, bleach, dye, and finish all sorts of yarns and fabrics—making those fabrics fit to fight!

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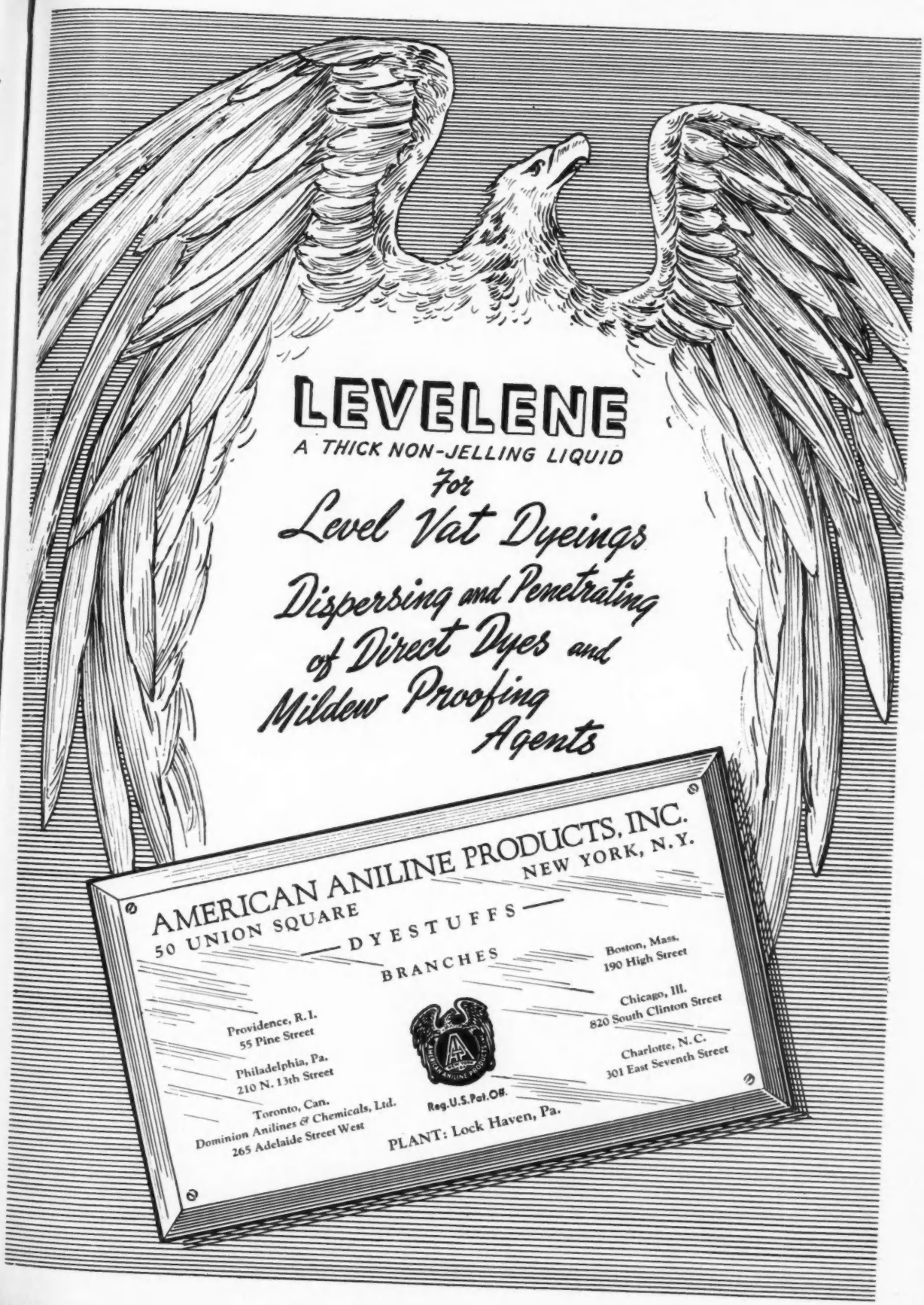
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They've come a long way from Valley Forge

U. S. Army Signal Corps Photo

WHEREVER they go – into the steaming jungles of New Guinea or the frozen wastes of the Aleutians – the U. S. Army is the best-dressed fighting force in the world. That's a glowing tribute to the speed and efficiency with which the Quartermaster Corps has equipped millions of American soldiers. It is also dramatic proof of the record achievements of a war-minded textile industry.

Imagine the millions of yards of finished fabrics required to equip and clothe an army of 5,000,000 men . . . not counting the civilian population back home! Here are a few figures that tell the exciting story of wartime expansion in the textile industry: In the twelve months, ending September, 1942, the industry consumed 50,000,000 pounds of rayon a month . . . over 4,309,079,500 pounds of cotton . . . 373,334,000 pounds of wool (exclusive of huge quantities of re-worked and re-used wool). A great part of this eight-to-twelve months consumption of textiles went into the manufacture of uniforms, underclothing, tents, sheeting, blankets, tarpaulins and a host of other goods urgently required by the Army, Navy and Marine Corps.

Here at Royce Chemical Company our job is to produce many of the processing agents needed to finish these strategic goods. Chief among these vital textile chemicals are Royce finishing oils . . . hydrosulphites . . . and desizing agents. In this all-important job of keeping our growing army better clothed than the fighting men of other nations, we are proud of the opportunity of joining hands with the textile industry in a great All-American effort.

MILITARY CLOTH REQUIRES THESE ROYCE CHEMICALS

VATROLITE—in the dyeing of vat colors for uniforms and equipment.
PAROLITE—for stripping synthetics and woolens prior to redyeing.
DISCOLITE—in vat color discharge printing of camouflage materials.
FABRITEX—as a thickener in the printing of nylon for parachute cloth.
NEOZYME—in desizing cotton ducks and other fabrics used to make tents, tarpaulins, hammocks, etc.
VELVORAY—as finishing oils in processing many types of cloth designated for military use.

ROYCE CHEMICAL COMPANY

CARLTON HILL, NEW JERSEY

MANUFACTURERS OF SULPHONATED OILS INCLUDING VELV-O-RAY*, CASTROLITE*, AND HYDROSULPHITES INCLUDING PAROLITE*, VATROLITE*, DISCOLITE*

*Reg. U. S. Pat. Off.

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